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Land & Water

Conserving Natural Resources in Illinois

University of Illinois at Urbana-Champaign, College of Agriculture, Cooperative Extension Service

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Returning to Grass Roots

Hay and Pasture Establishment

From Out Of The Ash

When the volcano Mount St. Helens erupted in 1980, it leveled forests, destroyed crops, killed millions of fish, choked harbors with volcanic mud, left human casualties, coated the ground with ash, and turned day into night.

In the ensuing months, one of the most common symbols of new life after this destruction was depicted in the photographs of seeded grass as it grew out from the ash.

Such photos are just one dramatic testimony to the durability of grass, a persistent, diverse organism that has a way of populating even the most forbidden land.

Grass has been nicknamed "nature's bandage" because it mends the wounds left by man. As one writer put it, "Grass covers the scars of battlefields, the trails of conquerors, and the graves of the mighty and the lowly. It has eaten the cobblestone chariot paths of the old empires and obliterated the mistakes of centuries."

But grass goes even farther than just patching up damage done to the earth. It can help to prevent damage from occurring in the first place. And the prime demonstration of this skill is its ability to reduce soil erosion.

A thick vegetative cover of grass protects the soil from its major enemies — wind and water — in a way that cannot be duplicated by any other plant. Grass absorbs the impact of raindrops, which pound the land and break apart soil particles; and it slows down the flow of runoff water, which carries away loosened soil particles.

Smooth bromegrass: A grass that combines well with alfalfa or red clover and is fairly tolerant of wet soils.

The Hay and Pasture Partnership

However, when it comes to forage production, grasses are only half of the erosion-controlling team.

The other half is plants of the pea family, or legumes. While grass reduces erosion more effectively than legumes, the legumes make it more economical to put the land into hay or pasture production.

Legumes have a higher nutrient value than grasses, and they better satisfy the high-protein needs of dairy cattle and other high-producing livestock. Some hay markets even demand a straight legume crop, rather than grass-legume mixtures.

But in cases in which it *is* acceptable to mix grasses and legumes, the team works well. Grasses provide more ground cover early in the spring while legumes provide increased cover in summer.

Saving Soil and Songbirds

Putting certain land into hay and pasture production may be doing this land a big favor. Here's why:

Presently, an estimated 10 million of the 24 million acres of cropland in Illinois suffer from excessive soil loss. There are several ways to solve the erosion problem on these acres, but one of the most effective strategies is to switch from continuous row crops to a rotation that includes a forage crop.

In fact, on 900,000 of those 10 million acres, a switch to permanent cover is essential for adequate erosion-control.

An additional but less-publicized advantage of putting some land into hay and pasture production is the benefit that doing so provides to wildlife populations throughout Illinois.

Studies made by the Illinois Natural History Survey indicate that as new farming practices in the 1960s reduced the amount of pasture habitat, prairie species of songbirds declined by as much as 50 percent per decade. For example, the Grasshopper Sparrow declined by 96 percent in just 20 years; the Meadowlark, by 84 percent; and the Bobolink, by 97 percent.

Returning erosive land to hay or pasture not only should revitalize these populations, but it may increase a farmer's net income in the process — assuming that a good market for the crop can be found. The most consistently profitable uses for forage crops have been for hay and grazing by beef and dairy herds; but there also are more specialized markets, such as high-quality hay for race horses.

For those who intend to reap these benefits by making the shift from row crops to forages, the first step is to examine the available grass and legume species.

Grass Species

Three high-quality grass species for forage in Illinois are timothy, smooth bromegrass, and orchardgrass. A fourth species, tall fescue, is widely grown in Illinois but is lower in nutritive quality than the other three.

Timothy is a cool-season species that goes dormant during hot weather, so it is best suited to the northern half of Illinois. Also, this perennial grass has an onion-like storage structure called a "corm," which enables it to withstand abuses such as overgrazing.

However, timothy is a bunch grass, so it provides less protection from soil erosion than sod-forming grasses such as smooth bromegrass, reed canarygrass, or Kentucky bluegrass. In addition, it is not as high-yielding and offers less midsummer production than smooth bromegrass or reed canarygrass.

Smooth bromegrass and orchardgrass are the other two top grass choices for high-quality feed in Illinois because both are high-yielding, palatable, and adaptable to a wide range of conditions.

Smooth bromegrass is a perennial, sod-forming grass with short rhizomes (underground stems) that establish new daughter plants. The resulting network of roots creates a sod that resists water erosion and makes smooth bromegrass a good pasture grass, especially for sharp-hooved animals such as horses.

Because smooth bromegrass is durable in cold weather, it is well-suited to the northern half of Illinois. It also combines well with alfalfa or red clover and is fairly tolerant of wet soils and short-term flooding. That is why it is often used for grassed waterways in Illinois.

On the other hand, smooth bromegrass has less summer production than orchardgrass or reed canarygrass when moisture is lacking and temperatures are high.

Orchardgrass, a perennial hay and pasture grass, is well-suited to the southern two-thirds of Illinois. Like timothy, it is a bunch grass and thus provides less erosion protection than sod-forming grasses.

Orchardgrass is early maturing, recovers rapidly after grazing, is heat-tolerant and moderately productive during hot summer months if soil moisture and fertility are available. It also combines well with alfalfa.

(For information on other grasses, see the accompanying descriptions.)

Legume Species

Originating in the Middle East and becoming popular in North America after 1850, alfalfa is now the highest-yielding perennial forage legume grown in the country. It also is one of the most popular crops grown for pasture in Illinois.

But why grow alfalfa in Illinois when you can produce 150 bushels per acre of corn? The answer for many growers is simple: for the protein and energy in alfalfa.

For instance, 10 tons of high-quality alfalfa hay contains approximately 4,000 pounds of protein, comparable to 760 bushels of corn or 160 bushels of soybeans. In energy, 10 tons of alfalfa hay provides 10,000 pounds of Total Digestible Nutrients (TDN), which equals 220 bushels of corn, or 25 tons of corn silage.

But not only is alfalfa unsurpassed in nutritional value, it offers versatility because it can be fed as hay, haylage, pasture, green chop, wafers, and pellets.

No other feed nutritionally performs so well with beef, dairy, swine, poultry, and horses. Although bloat in ruminant animals often is associated with alfalfa pastures, it is not an insurmountable problem. The bloat hazard can be reduced or essentially eliminated by balancing soil fertility, including grasses in mixtures with alfalfa, maintaining animals at good nutritional levels, and using bloat-inhibiting feed amendments.

In addition, alfalfa requires rotational grazing in pastures. With good grazing management and fertilization, alfalfa will persist four to six years in most pastures.

The second most important hay and pasture legume in Illinois is red clover. It does not have the yield potential of alfalfa under good production conditions, but it can persist in more acid soil condi-

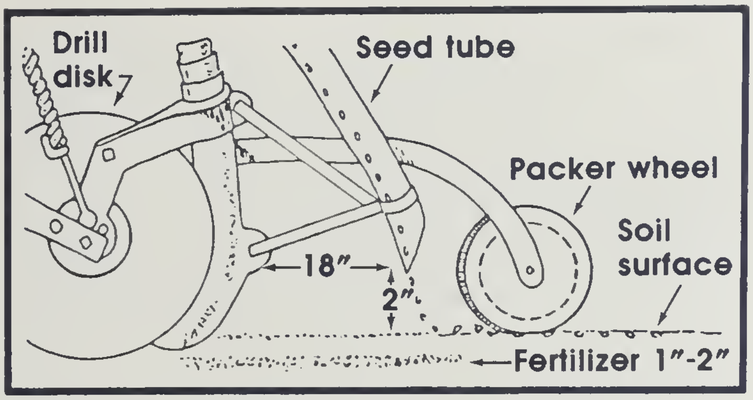

Figure 1. This depicts the placement of high-phosphate fertilizer and seed with a grain drill.

tions, under wetter soil conditions, and under more shade than alfalfa.

Red clover is physiologically a perennial, but root and crown diseases limit its life to about two years. New varieties, such as Arlington, Kenstar, Redland, and some privately developed varieties, have increased resistance to these diseases and are expected to be productive for at least three years.

Red clover also does not have as much seedling vigor or as rapid a seedling growth rate as alfalfa. Therefore, red clover does not fit into a spring seeding without a companion crop program as well as alfalfa does.

Because red clover has more shade tolerance at the seedling stage than alfalfa, it is recommended for most pasture renovation mixtures where there will be shading from existing grasses.

(For information on other legumes, see the accompanying descriptions.)

Forage Mixtures

Mixtures of legumes and grasses usually are desired because yields tend to be greater than with either the legume or the grass alone.

Grasses will fill in where the legume ceases to grow, reduce soil erosion, reduce the late winter-heaving damage, increase the drying rate, reduce the bloat hazard with ruminant animals and perhaps improve animal acceptance of the feed.

Mixtures of two or three well-chosen species are usually higher-yielding than "shotgun" mixtures of five or six species in which some of the species are not particularly well-suited to the soil, climate, or use.

Forage crop mixtures are listed in the *Illinois Agronomy Handbook,* published by the University of Illinois Cooperative Extension Service. Current copies of the handbook are available for $2 from your local county Extension office, or by writing to: Office of Agriculture Publications, 47 Mumford Hall, 1301 W. Gregory Dr., Urbana, Ill., 61801. (Make checks payable to the University of Illinois.)

Selecting And Preparing A Field

A successful pasture seeding begins with the selection of a well-drained field.

Soil with good internal drainage is a big asset in alfalfa and red clover production. But if the internal drainage is poor, good surface drainage becomes vital because ponding water is devastating to these perennial legumes. With good surface drainage, successful stands of alfalfa and red clover can even be established and maintained on the poorly drained claypan or fragipan soils.

Once a field is selected, its preparation becomes the key consideration. Seedbeds should be firm and tilled enough to provide good soil-seed contact. Also, leaving some crop residue on the surface will help reduce erosion while the forage crop is being established.

Seeding Equipment And Methods

The next step is to select your seeding method.

The double-corrugated-roller seeder, which drops seed uniformly between two corrugated rollers, is an excellent choice for forage crops. The first roller provides additional firmness to the seedbed, and the second roller presses the seeds into contact with the soil. Most of the seeds are covered lightly, which is desirable. This method is called broadcast seeding.

For band seeding — another good method — a grain drill with a legume seed box is used. As shown in Figure 1, hoses from the legume box carry the seed to the soil surface, trailing the drill disks.

You should use the drill to apply 50 to 100 pounds of phosphorus fertilizer per acre about 1 to 2 inches below the soil surface. Place legume seeds directly above this fertilizer band. It is not as critical to place grass seeds directly above the fertilizer band because grass roots branch out, rather than grow straight down as legume roots do.

For best results, press wheels (packer wheels) should follow directly over the seed, pressing the seed into the soil surface. The fertilizer should be covered with soil before the forage seeds are dropped — a process that occurs naturally when soils are in good working condition. A press wheel should then roll over the forage seeds to firm them into the soil surface, about ¼- to ½-inch deep.

But which is the better seeding method? In U of I studies (See Table 1), the band seeding method resulted in yields that were equal to or slightly greater than those with broadcast seedings. In particular, soils that are low in readily available phosphorus have produced greater yields with band seeding. Low available phosphorus may result from low natural fertility, inadequate fertilization, low pH, or cold, wet soil.

Preparing The Soil

To make sure that fertility and pH are adequate, take a soil test; and then apply lime and fertilizers at rates indicated in the current *Illinois Agronomy Handbook.*

Because it can be expensive and inefficient to add all of the necessary fertilizer at one time, the handbook recommends breaking this process into four yearly steps known as "the buildup system." In other words, it indicates how much fertilizer should

Table 1. Alfalfa Seeding Methods and Yields at Illinois Test Sites

Location and number of trials	Average annual yield, tons of dry matter per acre: Band seeding	Average annual yield, tons of dry matter per acre: Broadcast seeding
DeKalb, two trials	4.57	4.48
Urbana, three trials	5.60	5.60
Brownstown, two trials ..	3.11	2.92

be added each year for four years to bring soil fertility to the proper level. These are called buildup rates.

The handbook also specifies "management rates" for specific crops. The management rate is the amount of fertilizer that must be added each year to make up for the nutrients used by the growing plants.

When applying lime and fertilizers, keep in mind the following tips:

Lime

On newly prepared seedbeds, if the rate requirements for lime exceed 5 tons, apply half of it before primary tillage (in some cases, plowing), and half before secondary tillage (harrowing, disking).

Apply rates of less than 5 tons at one time, preferably after plowing; but either before or after is acceptable.

On established pastures or pastures being renovated without tillage, apply up to 3 tons of lime at any one time. If soil tests indicate a need for larger amounts, apply half now and the remaining half one or two years later.

Nitrogen

No nitrogen should be applied for legume seedings on soils above 2.5 percent organic matter. On soils with less than that, up to 20 pounds per acre may help assure rapid growth of legume and grass seedlings.

In the seedings of a pure grass stand, 50 to 100 pounds of nitrogen per acre in the seedbed is suggested. When band seeding, apply nitrogen with phosphorus through the grain drill, but do not place the seed in the fertilizer band. Allow 1 to 1½ inches of soil to cover the fertilizer before the seeds are dropped.

When broadcast seeding, apply nitrogen with phosphorus and potassium, and then incorporate with light tillage during final preparation of the seedbed.

Phosphorus

All of the phosphorus needs up to four years can be applied at seeding time. For band seeding, the bulk of your fertilizer may be broadcast with potassium before final seedbed preparation. However, apply a minimum of 30 pounds of P_2O_5 per acre with the drill in a band below the seed.

As for broadcast seeding, broadcast all of the phosphorus with potassium, preferably after primary tillage and before final seedbed preparation.

Potassium

Apply potassium before or at seeding, preferably by broadcasting. If you choose to broadcast seed, apply all potassium after the primary tillage. You can apply up to 600 pounds of K_2O per acre in the seedbed without damaging seedlings if the fertilizer is incorporated with thorough tillage.

However, if you are band seeding, you may safely apply a maximum of 30 to 40 pounds of potassium per acre in the band with phosphorus. The response to band fertilizer will be mainly due to the phosphorus, unless the potassium soil test is very low (perhaps 100 or less).

Planting Dates, Seeding Rates

In the northern quarter of Illinois, spring seedings for hay and pasture species are more successful than late-summer seedings; but in the southern one-third of the state, late-summer seedings are more successful. In central Illinois, you can go with either spring or late-summer dates.

The reason that late-summer seedings are preferred in southern Illinois is that wet soils and inclement weather usually hamper early spring seedings and timely weed control programs in that part of the state.

The spring-seeding date in northern Illinois is late March or early April, as soon as a seedbed can be prepared. An exception is when seedings are made in a fall-seeded winter annual companion crop. In this case, hay and pasture species should be seeded about the time of the last snow.

Spring seedings of grasses or legumes into spring oats should be done at the same time as the oats are seeded.

The late-summer seeding date is August 10 in the northern quarter of Illinois, August 30 in central Illinois, and September 15 in the southern quarter of Illinois. To assure that the plants become well-established before winter, seedings should be made close to these dates and not more than five days later.

The seeding rates for hay and pasture mixtures — which are indicated in the current *Illinois Agronomy Handbook* — are for average conditions when mixtures are seeded with a companion crop in the spring or without a companion crop in late summer.

If you seed alfalfa without a companion crop in the spring, you may want to use higher seeding rates. Higher rates have proven economical when alfalfa was seeded as a pure stand in early spring and two or three harvests were taken in the seeding year. Seeding alfalfa at 18 pounds per acre has produced 0.2- to 0.4-ton higher yields than seeding at 12 pounds per acre in northern and central Illinois, but not in southern Illinois.

Alfalfa may be established successfully in April in

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Grasses

In addition to timothy, smooth bromegrass, and orchardgrass (which are discussed in the general text), here are some other grass species that are used in Illinois:

Reed canarygrass is not widely used, but it has growth attributes that deserve consideration. Reed canarygrass is the most productive of tall perennial grasses that are well suited to Illinois hay and pasture lands. It tolerates wet soils but also is one of the most drought-resistant grasses and can utilize high fertility. It is coarser than orchardgrass or bromegrass and similar in coarseness to tall fescue.

Grazing studies indicate that reed canarygrass will produce good livestock gains equal to those of bromegrass, orchardgrass, or tall fescue under proper grazing management. It should be considered for grazing during spring, summer, and early fall. Cool temperatures and frost retard its growth and induce dormancy earlier than with tall fescue, smooth bromegrass, or orchardgrass. Varieties with improved animal acceptance and digestibility are available.

Tall Fescue, a high-yielding grass, is outstanding in performance when used properly, and it is a popular grass for beef cattle in southern Illinois. It is especially useful for winter pasture because it grows well in cool weather. Also, it is most palatable during the cool seasons of spring and late fall.

Evidence indicates that a fungus living within the plant tissue can lower the palatability and digestibility of this grass during the warm summer months. However, fungus-free varieties are now becoming available and may revolutionize the use of tall fescue on livestock farms.

Tall fescue is marginally winter hardy when used in pastures or hay crops in the northern quarter of the state.

Sudangrass, sudangrass hybrids, and sorghum-sudangrass hybrids are annual grasses that are very productive in late summer. These grasses, which need to be seeded each year on a prepared seedbed, may have a total season production that is less than that from perennial grasses with equal fertility and management. However, these annual grasses fill a need for quick, supplemental pastures or green feed, and they are extremely drought-tolerant.

Being tall, juicy grasses, they are difficult to make into high-quality hay. But if you do use them for hay purposes, choose sudangrass and sudangrass hybrids over the sorghum-sudan hybrids because they will dry more rapidly. Also, crushing the stems with a hay conditioner will help speed drying.

Millets are warm-season, annual grasses that are very heat-tolerant and drought-tolerant. Four commonly used millets are pearlmillet, browntop millet, foxtail or Italian millet, and Japanese millet.

Pearlmillet has been evaluated in grazing trials and is a suitable alternative for summer annual pastures. It requires a warmer soil for rapid establishment than does sudangrass. Seedings should be delayed until the seedbed's soil temperature averages 70 degrees Fahrenheit.

In addition, pearlmillet does not have the potential to poison livestock with prussic acid, as does sudangrass, nor is pearlmillet as susceptible to leaf diseases. It also is more drought-tolerant, thus producing more pasture during hot, dry periods of late summer than does sudangrass.

Native grasses, such as bluestem, Indian grass, and switchgrass, are warm-season perennial species that blanketed Illinois over 150 years ago when it was more accurately called the prairie state — before the prairie was plowed under.

However, native grasses are more fragile than cool-season grasses. They are more susceptible to competition from other plants and are more sensitive to overgrazing. Therefore, care must be taken not to allow them to be grazed too short.

Being warm-season species, prairie grasses produce well during the hot, dry period of summer — the time when cool-season grasses produce most poorly. One limitation, though, is that they can only be used for grazing during a six- to eight-week period in late July through August.

It takes longer to establish native grasses, so they do not provide as much soil cover in the early stages as other grasses. But once they are established, they do not have to be reseeded as often, and they provide more permanent soil cover.

As for other advantages, native grasses are aesthetically pleasing to many people and can create a nostalgic appreciation for the natural prairie that once flourished in Illinois.

Legumes

In addition to alfalfa and red clover (which are discussed in the general text), here are other popular legume species grown in Illinois:

Ladino clover is an important legume in pastures, but it has received little attention recently because of its short-lived character. The very leafy nature of ladino makes it an excellent legume for swine. It also is a high-quality forage for ruminant animals, but it often leads to problems of bloat.

Ladino lacks drought tolerance because its root system is shallower than that of red clover or alfalfa.

Birdsfoot trefoil has been popular in permanent pastures in northern Illinois. It has a long life but establishes slowly, and its seedling growth rate is much slower than that of alfalfa or red clover. Also, it tolerates wetter and more acid soils than alfalfa or red clover.

A root rot has made birdsfoot trefoil a short-lived crop throughout southern Illinois; but the variety Dawn has some resistance to increase its persistence throughout the state. Other varieties, which also may resist the root and crown rots and aid in longevity, are being developed.

Because birdsfoot trefoil is not as deep-rooted as alfalfa, it is not as productive during drought.

Crownvetch is well-known for protecting erosive soil areas. But as a forage crop, it is much slower in seedling emergence, seedling growth rate, early season growth, and recovery growth than alfalfa or red clover. The growth rate is similar to that of birdsfoot trefoil. The potential for crownvetch as a hay or pasture plant seems restricted to rough sites and soils of low productivity. Also, the palatability of crownvetch is less than birdsfoot trefoil, alfalfa, or red clover.

Sainfoin was introduced into the western United States from Russia. This species has failed to become well-enough established in Illinois tests to be able to make valid comparisons with alfalfa, red clover, and other legumes. But observations indicate that sainfoin has a slow growth and recovery rate and is not well-suited to the humid conditions in Illinois.

Hairy vetch is an annual legume that has limited value as a hay or pasture species because of its low production and viny nature. Hairy vetch may reseed itself and become a weedy species in small grain fields.

Lespedeza is a popular annual legume in the southern third of Illinois. It comes on strong in midsummer when most other forage plants are at their low ebb in production, and it survives on soils of low fertility.

However, it is low-yielding. It does not produce as well as a good stand of alfalfa, even in midsummer, nor will it encroach on a good alfalfa stand. As alfalfa or other vigorous pasture plants fade out of a pasture, lespedeza may enter.

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northern and central Illinois, and no companion crop is necessary if you use timely applications of herbicides. Preemergence herbicides have been satisfactory in most trials.

However, currently approved preemergence herbicides — Balan and Eptam — kill grasses, so they cannot be used if you intend to use a legume-grass mixture. Instead, you need to use the postemergence herbicide 2,4DB. It does not kill legumes or grasses, but it controls most broadleaved weeds, if applied when the weeds are not more than 2 or 3 inches tall.

No-Till Pastures

Some farmers choose to no-till seed pastures, usually in an effort to introduce legumes into an already existing grass pasture.

By interseeding legumes (alfalfa, red clover, or birdsfoot trefoil) into grass pastures without tillage, the production and quality of the pasture can be increased. Also, no-till seedings minimize soil erosion hazards by not completely destroying the existing pasture.

Here are the steps toward "legumizing" grass pastures:

1. Graze the pasture continuously and intensively 20 to 30 days before the seeding date. This reduces the vigor of the existing pasture plants so they will not compete as vigorously with the newly seeded species.

2. Fertilize according to the soil test. The pH should be 6.5 to 7.0. Apply lime at a rate proper for one-half the plow depth, and apply phosphorus and potassium as indicated by a soil test.

3. Apply herbicides for vegetation control. Paraquat or Roundup are approved. If Paraquat is used, 2,4-D should be applied two weeks before the seeding date.

4. Seed legumes with a no-till drill that places the seed into the soil surface and provides soil-seed contact.

5. Seed in late August to early September throughout the southern three-quarters of Illinois, and seed in early spring throughout the northern two-thirds of Illinois.

The late August seedings in no-till pasture renovation programs should be made a little earlier than the hay crop seedings on prepared seedbeds. There is more competition in pasture seedings, so the seedlings need more time to develop strong roots before winter.

6. Apply insecticides as needed. Leafhoppers, crickets, grasshoppers, and perhaps other soil and vegetation insects may become serious enough to require an insecticide application. An application of Furadan at seeding time aids in the control of soil insects.

Upside Down Land

Now we come full circle to reemphasize the first step in the whole process of establishing hay and pasture crops: that is, before you can establish a forage crop, the importance of grasses and legumes must become established in your mind.

In some cases, it may be necessary to develop the attitude of the Sioux Indian who was watching a farmer plow in 1883. As the plow turned under the prairie grass, the Indian's response was short and simple: "Wrong side up."

Obviously, it would be an exaggeration to imply by this anecdote that all pastures should be kept sunny-side up, rather than turned under to make room for other crops.

But isn't it equally unwise to maintain the notion that hay and pastureland is an entirely unrealistic option? And isn't this a particularly dangerous notion for those Illinois landowners who oversee a portion of the 900,000 acres in which permanent cover more effectively controls erosion and is more profitable than row crops?

If we are serious about controlling soil erosion, in certain cases it may truly be a mistake to plow up pasture. In certain cases, the Sioux Indian may be right. Turning the grass upside down may be paramount to turning the land wrong side up.

Prepared by Don Graffis, Extension agronomist; and Doug Peterson, Extension communications specialist.

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